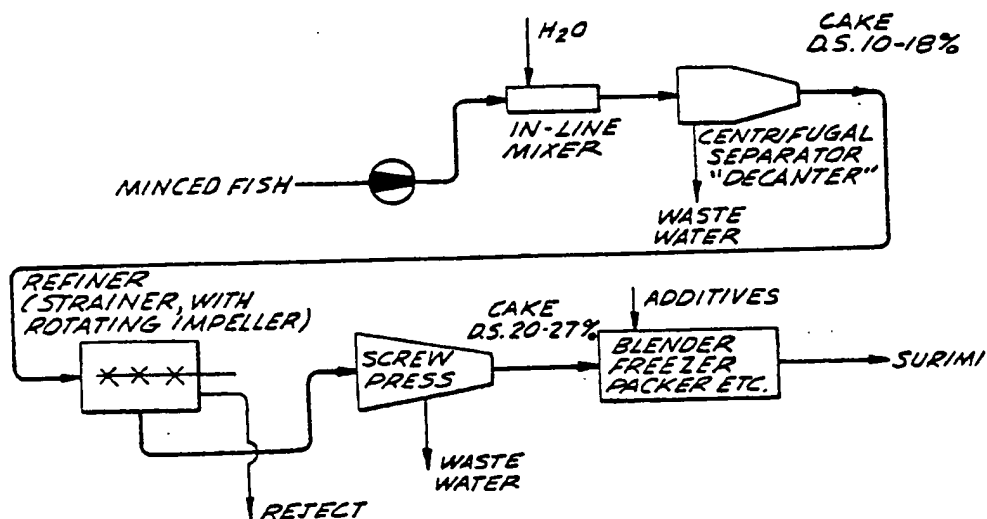




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(54) Title: PROCESS FOR PRODUCING FISH MEAT MATERIAL



## (57) Abstract

Process for producing a deboned, water washed fish meat material, more commonly called Surimi. The raw fish material is headed, gutted and minced to a particle size of about 3-4 mm. This minced material is then washed and mixed using in-line mixer means, e.g. a static mixer or a pump, and is washed and separated by using a centrifugal decanter, e.g. a centrifugal clarifier having a horizontal axis, to a fish meat dry solids content of about 20-27%. This can then be blended with cryoprotectants and other additives, frozen and packed.

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Process for producing fish meat material

The present invention relates to a process for producing a deboned, water washed, fish material, usually called Surimi.

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Surimi is a Japanese term for mechanically deboned fish meat that has been thoroughly washed with water and then mixed with additives, i.e. so-called cryoprotectants, for improved frozen shelf life.

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Surimi is used as an intermediate product for a variety of fabricated seafoods, such as flakes and crab legs. The aim of washing with water is not only to remove fat and undesirable matter, such as blood, pigments and odorous substances, but, more importantly to increase the concentration of myofibrillar protein (actomyosin) thereby improving gel strength and elasticity, essential properties for Surimi-based products.

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Surimi has a great potential as a functional protein ingredient which can be substituted for a variety of traditional animal and vegetable proteins. The virtually unlimited resources of underutilized fish species will ensure a sufficient production of Surimi at a reasonable cost to meet the need for base material for Surimi-based products.

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In Japan, Surimi has been produced for several hundred years. Traditionally, Surimi was freshly prepared from fresh fish and immediately processed into a variety of products.

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The technique evolved around A.D. 1100, when Japanese fishermen discovered that they could keep the product longer if washed minced fish was mixed with salt, ground up, and steamed or broiled. The traditional Surimi production was run on a day-to-day basis, depending on the supply of fresh fish. Consequently, the Surimi industry could not expand to any great

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extent and remained in a limited capacity. However, in 1959 a technique to stabilize frozen Surimi was discovered. It was found that an additive, i.e. a cryoprotectant, kept the Surimi from freeze denaturation during frozen storage. This discovery was the starting point for a rapid growth of Surimi production. For additional information about the development of the conventional process for production of Surimi, see Chong M. Lee, "Surimi Process Technology", Food Technology, pp. 69-80 (November 1984).

10

Basically, Surimi is produced by repeatedly washing separated fish meat with chilled water (5-10°C) until it becomes odorless and colorless - that is to say, until most of the water-soluble protein is removed. The temperature of the wash water is determined by the species of fish utilized. Warm water fish can tolerate a higher water temperature than cold water fish without a reduction in protein functionality. Originally, Surimi was made in a manual batch process, with at least three washing steps. Later, a commercial continuous process was developed. See Fig. 1. The fish is headed, gutted and minced to a particle size of about 3-4 mm. The minced fish is mixed with the appropriate amount of water in a ratio tank, and the mixture is pumped to a washer, that is to say, a tank with an agitator, and is then pumped to a rotating screen rinser, which comprises a cylindrical mantle having holes of about 1 mm diameter. Water is sprayed from the outside, and a flow of washed fish meat comes out of the rinser. Water which passes through the holes of the screen is discharged as waste. Usually there are three sets of washing tanks and rinsers. The washed fish meat, with a dry solids (D.S.) content of about 10-18 %, is then refined in a strainer having holes of about 1/2-1 1/2 mm, diameter in a cylindrical mantle. Horizontal shaft rotating blades drive the incoming fish meat toward the mantle, and pieces larger than the holes form a reject fraction, whilst the refined fish meat passes through the holes and is then dewatered in a screw press to a D.S. content

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of about 20-27 %. This dewatered cake is then blended with the cryoprotectant additive, 4 % sugar, 4 % sorbitol and 0.2 % polyphosphates and is then frozen and packed as Surimi product.

- 5 This conventional Surimi process is still rather old fashioned, even if it is continuous. There are many drawbacks inherent in the process. The overall yield of valuable fish protein is quite low, as the losses in the rather inefficient washing steps are large. The amount of water needed for washing is large. The fish
- 10 protein is exposed to air for a long time, which results in a great amount of hydrolysis and deterioration of the fish protein. The plant for carrying out the process requires a large floor area.
- 15 Accordingly, there is a need for an efficient process for producing Surimi, which overcomes the above mentioned deficiencies. It is therefore an object of the present invention to provide a continuous process, to produce Surimi in an efficient way, using smaller amounts of washing water and exposing the fish protein
- 20 to air for shorter periods of time. It is a further object of the present invention to provide a compact plant, requiring but a small amount of floor space, for carrying out the continuous process.
- 25 In the process of the invention, the minced fish material is mixed using in-line mixer means, e.g. a static mixer or a pump, and is washed by using a centrifugal decanter, e.g. a centrifugal clarifier having a horizontal axis. The process according to the invention increases the yield of Surimi by up to 50 %,
- 30 requires the use of 25-50 % less washing water, requires a shorter amount of time (about 1.5 minutes as compared to 15 minutes for the conventional process), requires less staff and less space to perform, requires fewer components and results in a higher quality product, having higher gel-strength, lower
- 35 water content and appearing whiter in color than product produced by the conventional process.

The present invention relates to a process for producing a deboned, water washed fish meat material, more commonly called Surimi, in which the raw fish material is headed, gutted and minced to a particle size of about 3-4 mm. The minced material is washed with chilled water until it becomes odorless and colorless, and the washed material is then dewatered to a fish meat having a D.S. content of about 18-22 %, which could then be blended with additives such as sugar, sorbitol and polyphosphates, frozen and packed.

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Fig. 1 illustrates a conventional process of making Surimi (such as that described in the above-cited article from Food Technology).

15 Fig. 2 depicts a process according to the invention wherein minced fish is mixed with water and washed in in-line mixer means and separated in a centrifugal decanter into a first fraction of fish meat which is strained and further dewatered in a screw press.

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Fig. 3 depicts another process according to the invention wherein minced fish is mixed with water and washed in in-line mixer means and separated in a centrifugal decanter into a first fraction of fish meat having a high dry solids content of 22-27 %

25 which is then strained.

Fig. 4 depicts another process according to the invention wherein minced fish is strained to remove bits of bone, tendon, skin and other impurities, mixed with water and washed in in-line mixer means and thereafter separated in a centrifugal decanter into a first fraction of fish meat which is further dewatered in a screw press.

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Fig. 5 depicts another process according to the invention wherein minced fish is strained, mixed with water and washed in in-

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line mixer means and separated in a centrifugal decanter into a first fraction of fish meat having a high dry solids content of 20-27 %, to which fraction is added cryoprotectants and other additives.

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According to the invention the improvement over the conventional process lies firstly in the washing of the minced fish material, which is carried out by mixing a flow of minced material with washing water in efficient in-line mixer means, such as a static mixer (e.g., a pipe provided with internal baffles to create turbulence) or a pump, and secondly in the dewatering of the mixture so obtained in a centrifugal decanter with horizontal axis, to separate the mixture into a first fraction of fish meat and into a second fraction of waste water, containing impurities and protein losses which can be recovered if desired.

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The second fraction of waste water can be further separated in a high speed centrifugal clarifier into a third fraction of recovered protein material and a fourth fraction of waste water.

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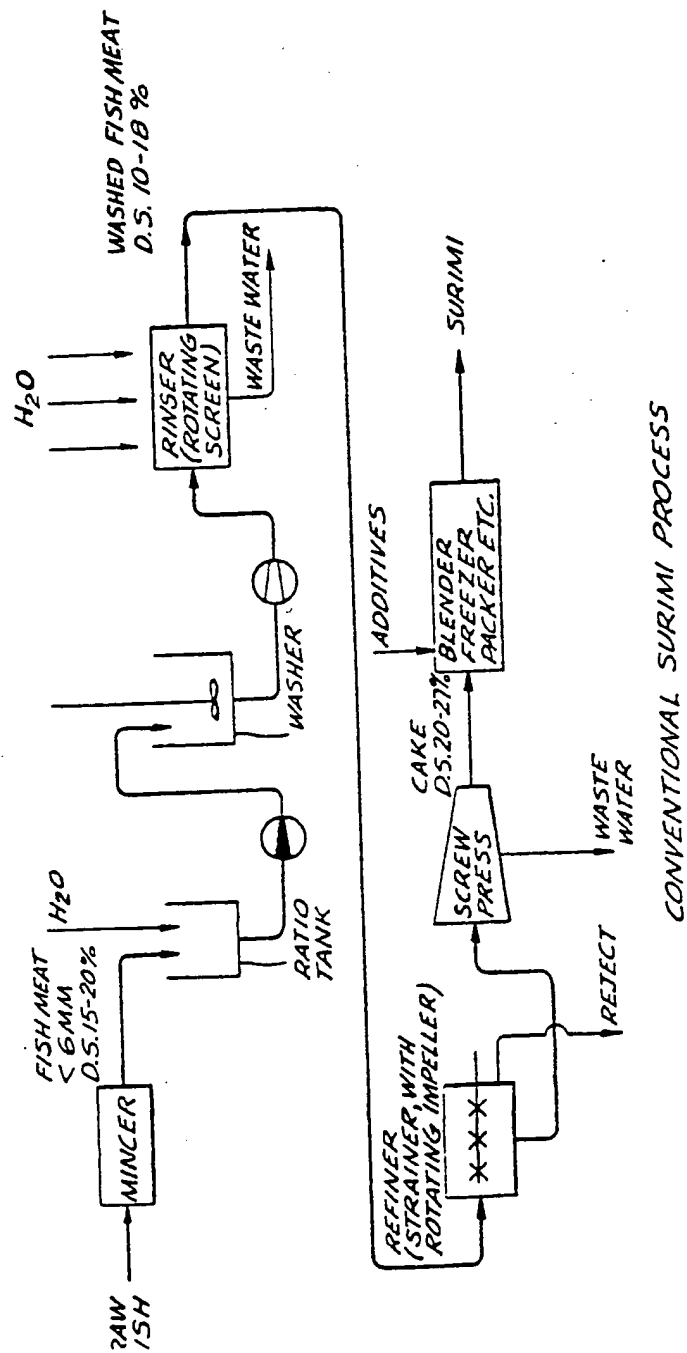
The third fraction of recovered protein material can be blended with the first fraction of fish meat or can be handled in an independent process line to yield a deboned, water washed fish meat material.

Claims

1. A continuous process for producing a deboned, water washed fish meat material, characterized by the following steps:
- mincing headed and gutted fish raw material to a particle size of about 3-4 mm,
  - mixing and washing the minced material with water in in-line mixer means,
  - separating the mixture in a horizontally disposed centrifugal decanter into a first fraction of fish meat having a dry solids content of about 10-18 % and a second fraction of waste water, and
  - further dewatering said first fraction of fish meat.
2. Process according to claim 1, characterized by straining said first fraction of meat in a refiner having holes of about 1/2-1 1/2 mm diameter and thereby dividing said first fraction into a refined fish meat fraction which passes the holes and a reject fraction which does not pass the holes and further dewatering said refined fish meat fraction to a dry solids content of about 20-27 %.
3. Process according to claim 1, characterized by dewatering the mixture in the centrifugal decanter until a first fraction of fish meat with a dry solids content of about 20-27 % is obtained, straining said first fraction of fish meat in a refiner with holes of about 1/2-1 1/2 mm diameter and blending the refined fish meat fraction with cryoprotectant additives before storing same.



4. Process according to claim 1, characterized by straining the minced material in a refiner having holes of about 1/2-1 1/2 mm diameter prior to the mixing and washing step and dewatering the first fraction of fish meat obtained from the  
5 decanter to a dry solids content of about 22-27 % and blending said further dewatered fish meat with additives before storing.
5. Process according to claim 1, characterized by straining the minced material in a refiner having holes of  
10 about 1/2-1 1/2 mm diameter prior to the mixing and washing step and separating and dewatering the fish mixture in the centrifugal decanter into a first fraction of fish meat having a dry solids content of about 20-27 % and blending the said first fraction with additives before storing the same.
- 15 6. Process according to any of the preceding claims, characterized by separating said second fraction of waste water in a high speed centrifugal separator (clarifier) into a third fraction of recovered protein material and a fourth  
20 fraction of waste water and blending said third fraction with said first fraction of fish meat or handling the same in an independent process line to yield a deboned, water washed fish meat material.
- 25 7. Process according to any of the preceding claims, characterized in that the in-line mixer means is a pump.
8. Process according to any of the preceding claims,  
30 characterized in that the in-line mixer means is a static mixer, comprising a pipe having internal baffles to create turbulence therein.



CONVENTIONAL SURIMI PROCESS

FIG.1

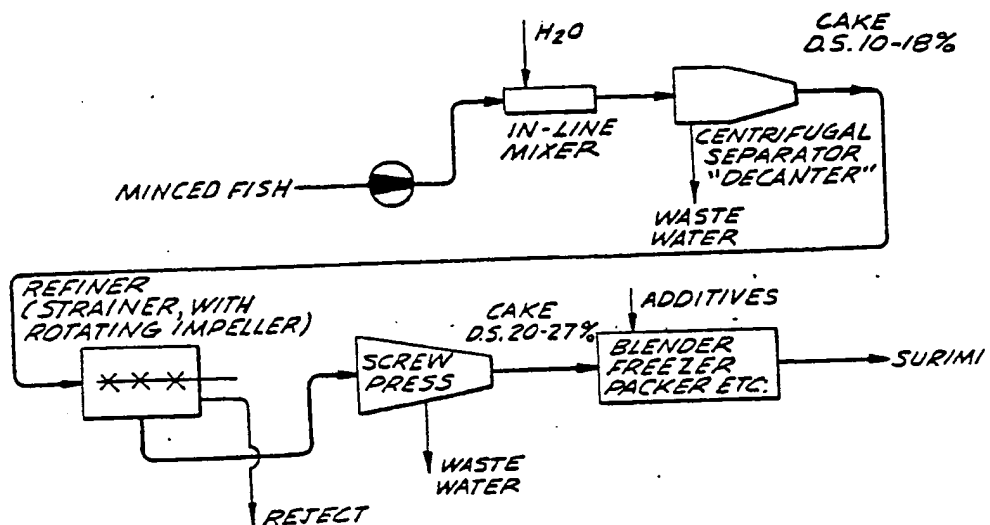


FIG. 2

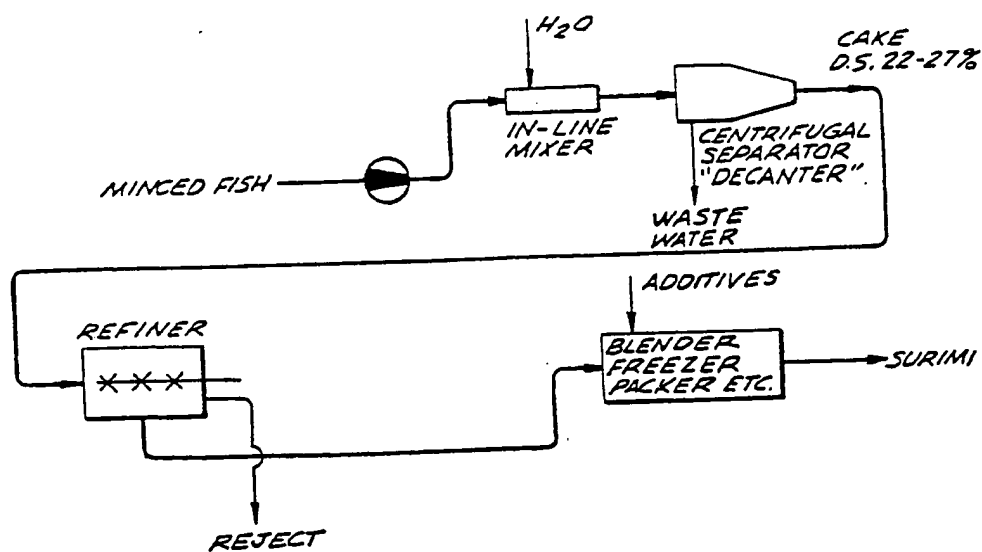


FIG. 3

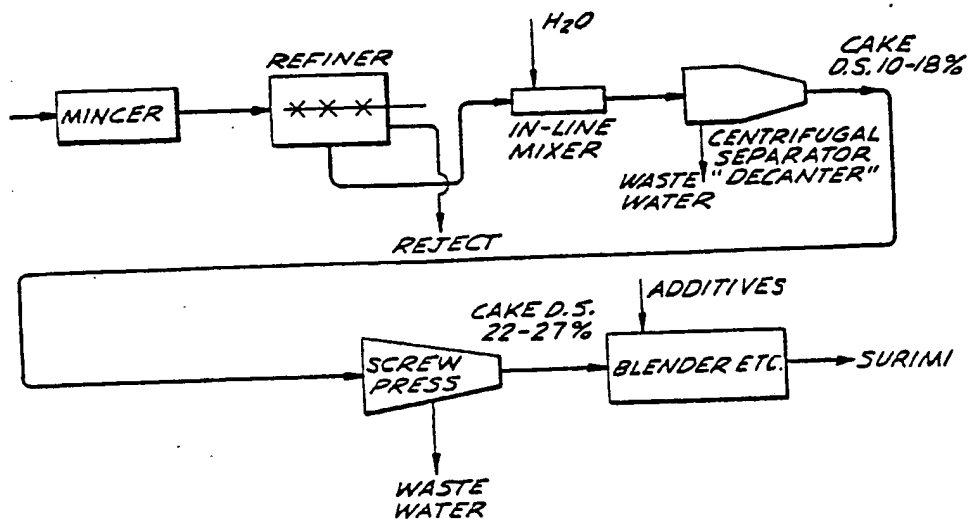
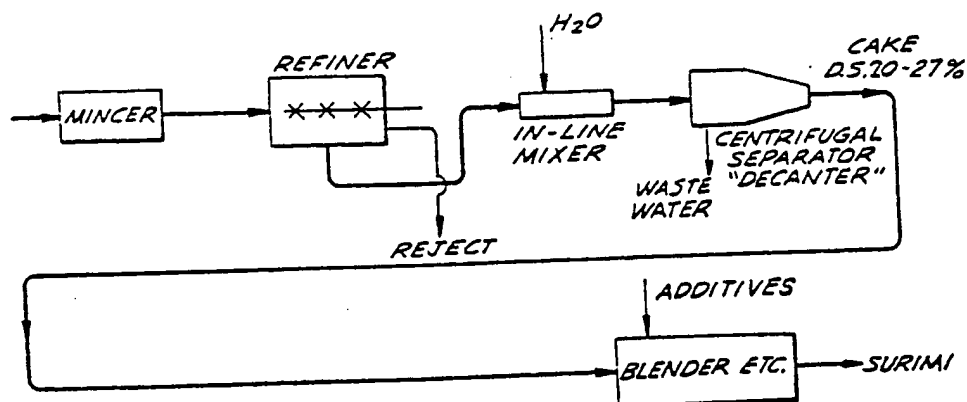


FIG. 4



# INTERNATIONAL SEARCH REPORT

PCT/SE86/00314

International Application No

## I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) <sup>6</sup>

According to International Patent Classification (IPC) or to both National Classification and IPC <sup>4</sup>

A 23 L 1/325

## II. FIELDS SEARCHED

Minimum Documentation Searched <sup>7</sup>

Classification System

Classification Symbols

IPC

A 23 L 1/325

US Cl

426:104, 231, 285, 471, 472, 512, 513, 574, 575,  
643, 656

Documentation Searched other than Minimum Documentation  
to the extent that such Documents are included in the Fields Searched <sup>8</sup>

SE, NO, DK, FI classes as above

## III. DOCUMENTS CONSIDERED TO BE RELEVANT <sup>9</sup>

Category <sup>10</sup> Citation of Document, <sup>11</sup> with indication, where appropriate, of the relevant passages <sup>12</sup> Relevant to Claim No. <sup>13</sup>

A	Patent Abstracts of Japan, Vol. 8, No 98, C 221, abstract of JP 59-14776, publ. 1984-01-25.	1
A	US, A, 4 207 354 (NIPPON SUISAN KABUSHIKI KAISHA) 10 June 1980 See claim 1, lines 27-32.	1
A	US, A, 4 181 749 (SNOW BAND MILK PRODUCTS CO., LTD.) 1 January 1980 See column 2, lines 3-11.	1
A	WO, A1, 82/02819 (BALTIC FISH LTD APS ET AL.) 2 September 1982 See page 7, lines 5-8.	1
A	US, A, 4 344 976 (ALFA-LAVAL AB) 17 August 1982 See claim 1, lines 16-19. & SE, 426544	1

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## IV. CERTIFICATION

Date of the Actual Completion of the International Search

Date of Mailing of this International Search Report

1986-09-10

1986-09-17

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III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
P	EP, A2, 0 159 038 (SUGIYO CO., LTD.) 23 October 1985 See page 3, lines 4-10	1